TYPE K CARRIER TELEPHONE SYSTEMS

PORTABLE K1 LINE AMPLIFIER

CONTENTS

1. GENERAL

1.01 This section covers the description and method of assembling a standard K1 line amplifier, together with associated equipment in a plywood carrying case to permit its use on a portable basis in connection with the maintenance of Type K carrier telephone systems. It also covers the initial tests which should be made after the portable amplifier is assembled, together with instructions for its use.

1.02 When K carrier routes were first established, spare facilities were provided to facilitate maintenance. The spare amplifiers thus made available were used to patch out the working amplifiers by means of the amplifier switching circuits so that vacuum tube replacement and other maintenance work could be done without releasing the working system from service. As service demands increased, the spare facilities were placed in service and it became necessary to release working facilities from service to carry out the maintenance work.

1.03 The use of the portable K1 line amplifier described herein, will permit the carrying out of maintenance work at line amplifier stations without releasing the Type K facilities involved from service. The portable line amplifier cannot be used at twist or deviation regulator points as the output of the line amplifiers at such points is not brought out to jacks. This should not be a serious handicap, however, since these points are for the most part attended and arrangements can be made to do maintenance work during the light service periods when releases can be obtained.

2. DESCRIPTION OF CIRCUIT ARRANGEMENTS

2.01 The portable amplifier consists of a standard K1 line amplifier per Drawing SD-64337-011 mounted in a plywood carrying case with one additional 30-type equalizer and suitable jacks, cords, keys, and switches described below. The assembled unit weighs approximately 45 pounds. Figure 1, attached, shows a face view of the portable amplifier.

2.02 The K1 line amplifier is normally equipped with one of four 30-type basic equalizers. In practice, about 85% of the basic equalizers are either 30A or 30B. By using these two equalizers in the portable amplifier, the equalization

is proper in all but about 15% of the cases. In the latter cases, the use of the 30A for the 30C equalizer, or the 30B for the 30D, results in a maximum level change of about 2 db in Channel 12, and 1 db in Channel 1. In most cases the resulting level change would be absorbed by the deviation regulator, and in any case, would not be serious from the voice standpoint. As voice frequency carrier telegraph systems are, in general, assigned to the lower channels, the resulting level change, which would not exceed about 1 db, should not prove troublesome. The transfer from the 30A to the 30B equalizer is made by means of a CIGU key, or equivalent, the wiring of which is shown in Figure 2, attached. In the operating procedure this key is identified as the EQL key.

2.03 Gain strapping changes in the line amplifier consist in connecting the grid of the first tube to either Step 6 or 7 of the input transformer and by connecting Terminal 7 of the 30-type equalizer to either Terminal 6, 8, or 10 of the equalizer. In addition, there is an X strap, a Y strap and a strap from Terminal 5 to 8 of the input transformer. The X strap is intended to provide additional margin against singing when a high gain is required. The Y strap and an external grid battery give a greater load carrying capacity but cannot be used for low gains. The 5-8 strap is used to maintain a constant regulating rate when Step 7 of the input transformer is used instead of Step 6.

2.04 In the portable amplifier, for the sake of simplicity in making the gain strapping changes, the X, Y and 5-8 straps are omitted. It is expected that since the portable amplifier will be used only occasionally in a system to patch out an amplifier, the omission of the above straps will not be serious. In addition, the omission of the Y strap permits making the portable amplifier self-biasing with a resulting simplification of the battery supply circuit. Figure 2, attached, shows the wiring of the No. 1410 switch to change the gain strapping connections on the 30-type equalizers. This is a two-gang three-step switch. In the operating procedure this switch is identified as the GAIN CONTROL switch. A note on this figure covers the use of the 552-A key to change the gain strapping connections on the input transformer. In the operating procedure this key is identified as the INPUT TRANS key.

2.05 It is felt that the need for automatic regulation in the portable amplifier would not justify the complex arrangements needed to retain this feature. For this reason no provision is made in the portable amplifier for the automatic operation of the 100-A regulator, so that the autosyn motor is not required and should be removed. The GR condenser is set by hand, as required, and held in place by the clamping arrangement used to hold the GR condenser fixed in shipment. This detail is mounted on the left side of the gear control housing and it may be used as a brake by loosening the two screws which hold it in place. Where extended use of the portable amplifier in aerial cable sections requires regulation, it should be provided manually as covered hereinafter.

2.06 Connection to the plate and heater power supplies is obtained by two patch cords which are patched to two jacks which should

be provided in the miscellaneous jack strip of the sealed test terminal bays of each office where the portable amplifier is to be used in accordance with Figure 3, attached. As shown in Figure 3, a slightly different arrangement is required at main and auxiliary stations. The following cords and plugs are required:

Supply	Cord and Plug Assembly	Cord Type	Plug Type
Heater	2-W 35A	2-W BY	47 or 347.
Plate	2-W 30A	2-W BR	109 or 309

2.07 Care should be exercised in connecting the cords to the amplifier in order to avoid turning over the ground and battery leads. As shown in Figure 3, the ground is connected to the sleeve of the jacks in all cases except for the heater circuits in auxiliary stations. In this case, the ground lead is connected to the tip of the jack and the 21.7 volts to the sleeve.

2.08 Referring to Drawing SD-64337-011, the tip side of the plate cord should be connected to punching No. 8 on the terminal strip and the sleeve side to terminal punching No. 1. The heater cord should have the tip side connected to terminal punching No. 5 and the sleeve to terminal punching No. 6. Terminal punchings Nos. 2, 3 and 5 on the amplifier panel should be strapped. This strapping connects ground to the cathode in auxiliary stations and - 24 volts to the cathode in main stations and, in addition, makes the amplifier self-biasing by strapping leads GT and K together.

2.09 Two 218-A jacks are provided at the amplifier input and two at the amplifier output to permit picking up the portable amplifier with patch cords. Care should be exercised to see that no wiring turnover is introduced by these jacks. The tip of the T jack of the input jacks should be connected to Terminal 1 of the input transformer and the tip of the R jack to Terminal 4. The tip of the T jack of the output jacks should be connected to Terminal 1 of the output transformer and the tip of the R jack to Terminal 4.

3. CONSTRUCTION AND ASSEMBLY OF CARRYING CASES

3.01 The following material is required to construct the carrying case and assemble the portable amplifier:

List of Material for Portable Amplifier

- 1 Line amplifier per J-68741-A
- 1 30-A equalizer
- 1 30-B equalizer
- 1 2-W 35-A cord and plug assembly (2-W BY cord equipped with 47 or 347-type plug)
- 1 2-W 30-A cord and plug assembly (2-W BR cord equipped with 109 or 309-type plug)
- 2 201-B jack mountings (or equivalent)
- 4 218-A jacks
- 1 CIGU key (or equivalent)
- 1 Two-gang Centralab No. 1410 selector switch (or equivalent). Purchase locally at radio supply store.
- 1 552-A key (or equivalent)
- 1 Pair detachable hinges approximately 1-1/4" long
- 1 Small hasp with hook fastener
- 1 Handle similar to the one used on 30-A transmission measuring set
- 24 Wood screws No. 6 FH 1-1/4" long
- 4 Wood screws No. 8 RH 1-1/4" long
- 4 Stove bolts RH 3/16" x 1"

8 Stove bolts FH 1/8" x 1"
4 Washers 3/16" bore
4 Lock washers 3/16" bore
Approximately 5 sq. ft. 1/2" plywood
Approximately 5-1/2 sq. ft. 1/4" plywood
Approximately 3 linear ft. 1" white pine approximately 5" wide

List of Material for Power Supply in Each Main or Auxiliary Station

2 218-A jacks
2 246-A jacks
Approximately 25 feet 16 gauge paired wire
Approximately 25 feet 22 gauge wire

3.02 Figures 4 and 5, attached, show the various pieces which should be cut out from the plywood and white pine stock for constructing the carrying case. Figures 6 and 7, attached, show how the parts should be assembled.

3.03 In the construction of the carrying case the following applies:

(1) Butt joints may be used. All joints should be glued and nailed with finishing nails.

(2) The nails should be countersunk and the holes then filled with plastic wood.

(3) The wood mounting cleats should be attached with wood screws from the outside. This will allow removal of the entire chassis if required for maintenance purposes.

(4) The plywood panels within the box and the amplifier panel should be fastened to the wood mounting cleats with wood screws.

(5) The entire inside and outside of the carrying case should be painted with two coats of shellac. In addition, the exterior should be painted with two coats of olive green enamel.

3.04 The length of the wiring between the two 30-type equalizers and the EQL key should be kept to the minimum. To facilitate this, the EQL key should be installed on the edge of the plywood panel. By installing the key in this manner, it may be removed allowing the panel to be opened for maintenance purposes if and when it becomes necessary to inspect or repair the portable amplifier.

3.05 In order to avoid singing of the amplifier and other transmission difficulties, all keys, jacks, and switches should be located as shown in Figure 1 and all details of construction should be as shown in Figures 4 to 7, inclusive.

3.06 Before fastening the amplifier in the carrying case with wood screws, try the 554-A GC condenser dial to determine if sufficient space has been provided for allowing the screw driver end to engage the slotted end of the GC condenser shaft. If sufficient space has not been allowed, additional space may be obtained by placing shims under the wooden cleat or by raising the cleat.

4. INITIAL AND PERIODIC TESTS

4.01 In general, the initial tests to be made on the portable amplifier are the same as those which are made on a newly installed K1 line amplifier. One additional test should be made with the GC and GR condensers on maximum, as this represents the most adverse condition under which it would have to

work in practice. It is essential that the amplifier will not sing under this condition. Table 1 shows the tests to be made and the order in which they should be made. It should be noted that some of the test requirements are slightly different from those which apply to a standard K1 amplifier. This is due to the omission of certain of the gain straps as discussed previously.

TABLE 1

Test	Test Conditions		Test Procedure	Requirements
(1) Vacuum Tubes	-		2(C) E34.560	2(C) E34.560
(2) Maximum Gain at 60 kc	GC Condenser - Max. GR Condenser - Max.	3(B)	E34.560	See table below
(3) Reference Gain at 60 kc and slope at 28 kc and 12 kc	GC Condenser - Min. GR Condenser - Step 30	3(C)	E34.560	See table below
(4) GR Condenser Range at 28 kc	GC Condenser at mid-position GR Condenser on Steps 47 and 7, resp.	3(H)	E34.560	See table below
(5) GC Condenser Range at 28 kc	GR Condenser on Step 30 GC Condenser on Max. and Min., resp.	3(I)	E34.560	The difference in gain for the maximum and minimum position of the GC condenser should be 9.6 ± 1.0 for any strapping.

(2) Maximum Gain at 60 kc

30-Type Equal	Gain Strapping 6-6	7-6	6-8	7-8	6-10	7-10
30-B	88.0	82.5	81.5	76.3	74.8	69.5
30-A	86.5	81.0	80.0	74.8	73.3	68.0

The 60 kc gain should be within ± 2.0 db of that shown and in addition amplifier should not sing.

(3) Reference Gain at 60 kc and slope at 28 kc and 12 kc

30-Type Equal	Gain Strapping 6-6	7-6	6-8	7-8	6-10	7-10
30-B	71.1	65.5	64.1	58.5	57.2	51.6
30-A	69.3	63.7	62.4	56.8	55.5	49.9

The 60 kc gain should be within ± 1.5 db of that shown.

The 28-60 kc slope should be 13.4 ± 0.8 db for 30-B equal and 11.9 ± 0.6 db for 30-A equal.

The 12-60 kc slope should be 21.5 ± 0.9 db for 30-B equal 18.7 ± 0.7 db for 30-A equal.

(4) GR Condenser Range at 28 kc

Strappings	Diff. in Gain with GR Condenser on Steps 47 & 7
6-6, 6-8, 6-10	10.0 ± 0.6 db
7-6, 7-8, 7-10	10.5 ± 0.6 db

4.02 No routine maintenance tests are required except vacuum tube tests as covered in Part 5, "Procedure for Use."

5. PROCEDURE FOR USE

5.01 The procedure shown below shall be followed when using the portable amplifier.

(1) Place portable amplifier in front of sealed test terminal within reach of the cords associated with the amplifier switching circuit.

(2) Connect heater power to the amplifier by patching the 2-W 35-A cord and plug assembly of the portable amplifier to the 218-A heater jack installed in the miscellaneous jack strip for this purpose.

(3) Connect plate power to the amplifier by patching the 2-W 30-A cord and plug assembly of the portable amplifier to the 246-A plate jack installed in the miscellaneous jack strip for this purpose.

(4) Allow five minutes for amplifier to stabilize.

(5) Make vacuum tube tests in accordance with Part 2 (C) of E34.560. The filament activity test may be omitted if this test was made within the past month.

(6) Determine gain strapping and type of basic equalizer from designation card of amplifier to be patched also setting of the GR condenser.

(7) Operate the EQL key to position "A" if 30-A or 30-C equalizer is employed or to position "B" if 30-B or 30-D equalizer is employed.

(8) Operate the INPUT TRANS key to give gain strapping connection to Terminal 6 or 7 of input transformer as required.

(9) Operate the GAIN CONTROL switch to give gain strapping connection to Terminal 6, 8, or 10 of equalizer as required.

(10) Adjust the setting of the GR condenser of portable amplifier to give the same reading as that of the amplifier to be patched. The clamping arrangement should be tightened to hold this setting. For patching nonregulating amplifiers the GR condenser should be set on zero.

(11) If gain measuring equipment is available, measure the gain of the portable amplifier and adjust the GC condenser by means of the 554-A tool until the 28 kc gain equals the required working gain of the amplifier to be patched. The working gain is determined from the lineup gain corrected for the working step of the flat gain controller as covered in Part 3 (E) of Section E34.560.

(12) If gain measuring equipment is not available, determine the setting of the GC condenser of the amplifier to be patched by means of the 554-A tool and using this tool set the GC condenser of the portable amplifier to give a corresponding reading. In many cases the GC condenser setting is recorded on the designation card and where this was not done, the setting determined herein should be recorded so that it will not be necessary to recheck it at some future date.

Caution. In determining the setting of the GC condenser by means of the 554-A tool care should be exercised to see that the setting of the GC condenser is not disturbed.

(13) The portable amplifier may now be used to patch out the working amplifier using the amplifier switching circuit as covered in Section E34.066.

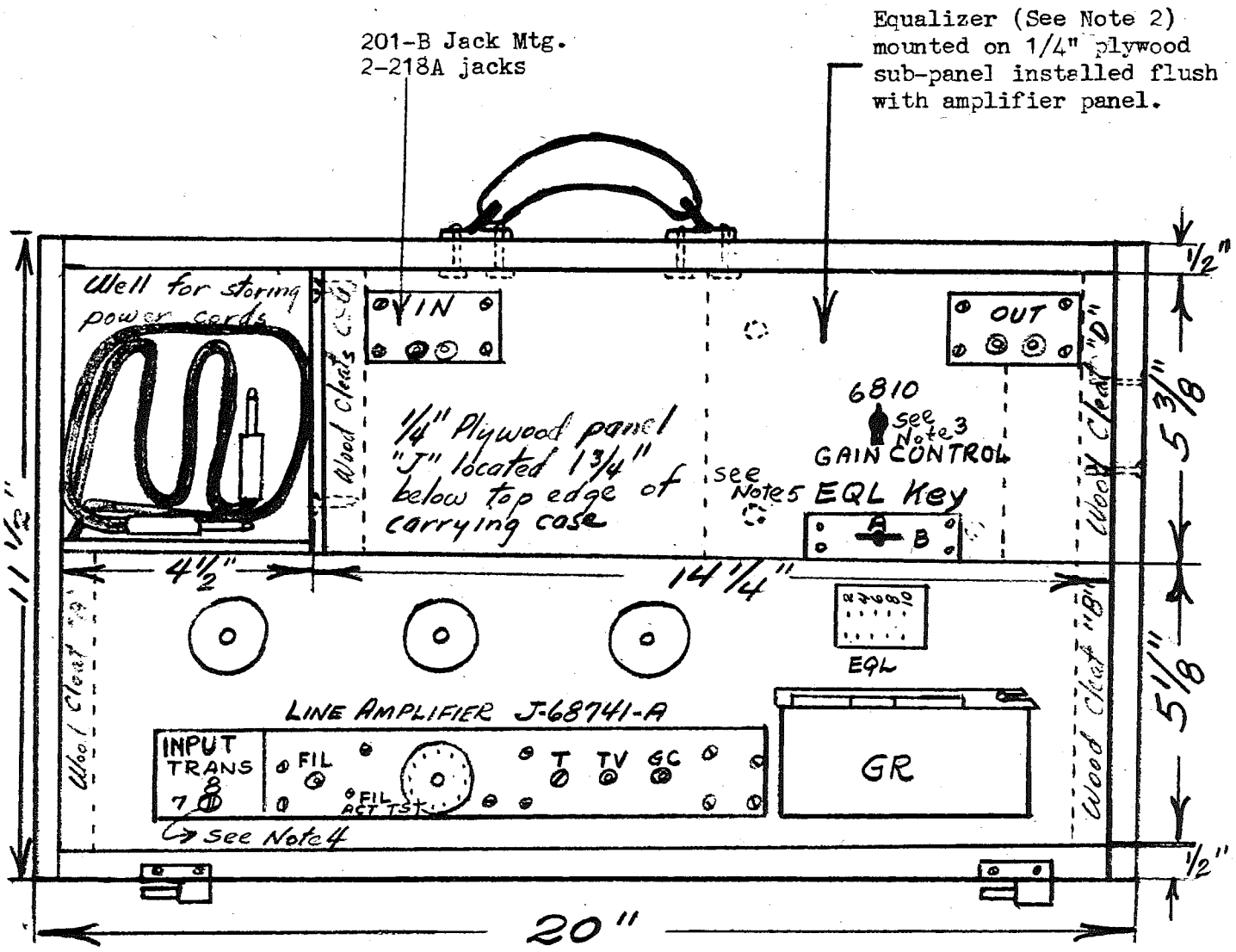
(14) Repeat Steps (6) to (13) for each additional amplifier which it is desired to patch.

(15) If the portable amplifier is to be left in service for an extended period in an auxiliary station, the heater battery supply sections should be adjusted to compensate for the extra drain, as covered by Note 1 on Figure 3, attached. This will not be necessary if the portable amplifier is to be used only for a few hours for vacuum tube replacements.

(16) If the portable amplifier is to be left connected to a line in an aerial cable section for an extended period of time, manual regulation should be provided by changing the GR condenser periodically by hand to correspond to the setting of the Flat Gain Master Controller involved.

5.02 For convenience in using the portable amplifier, the foregoing instructions may be typed in abbreviated form on a designation card which will fit in the 2B card holder which should be installed on the panel of the portable amplifier.

Attached: Figs. 1 to 7 inclusive



SIDE VIEW

Scale 1" = 3"

PORTABLE TYPE K AMPLIFIER.

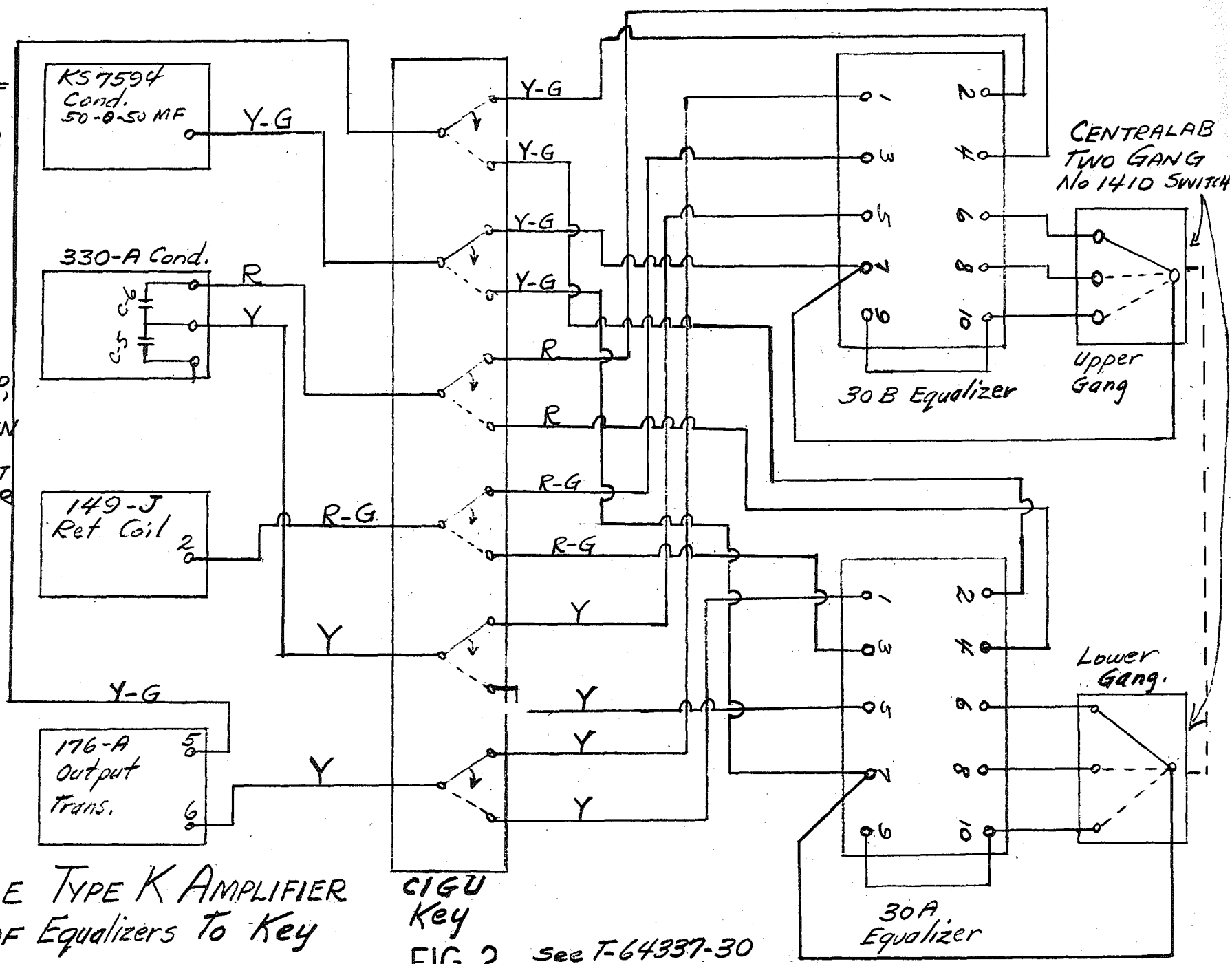
FIG. 1

NOTES:

1. Use 1/2" plywood for top, bottom and ends. The front, back and inside panels may be 1/4" plywood. All joints shall be glued and nailed with finishing nails. Paint carrying case with two coats of olive green enamel.
2. This must be a 30-A equalizer if a 30-B equalizer is provided in amplifier. If amplifier has a 30-A, the spare must be 30-B.
3. Use CENTRALAB two Gang No. 1410 selector switch, or equivalent, for equalizer strapping.
4. Use 552-A key for variable strapping of 293-A input trans. Mount key on metal or wood detail as shown.
5. **Use C1GU key or equivalent for EQL key.**

NOTES:

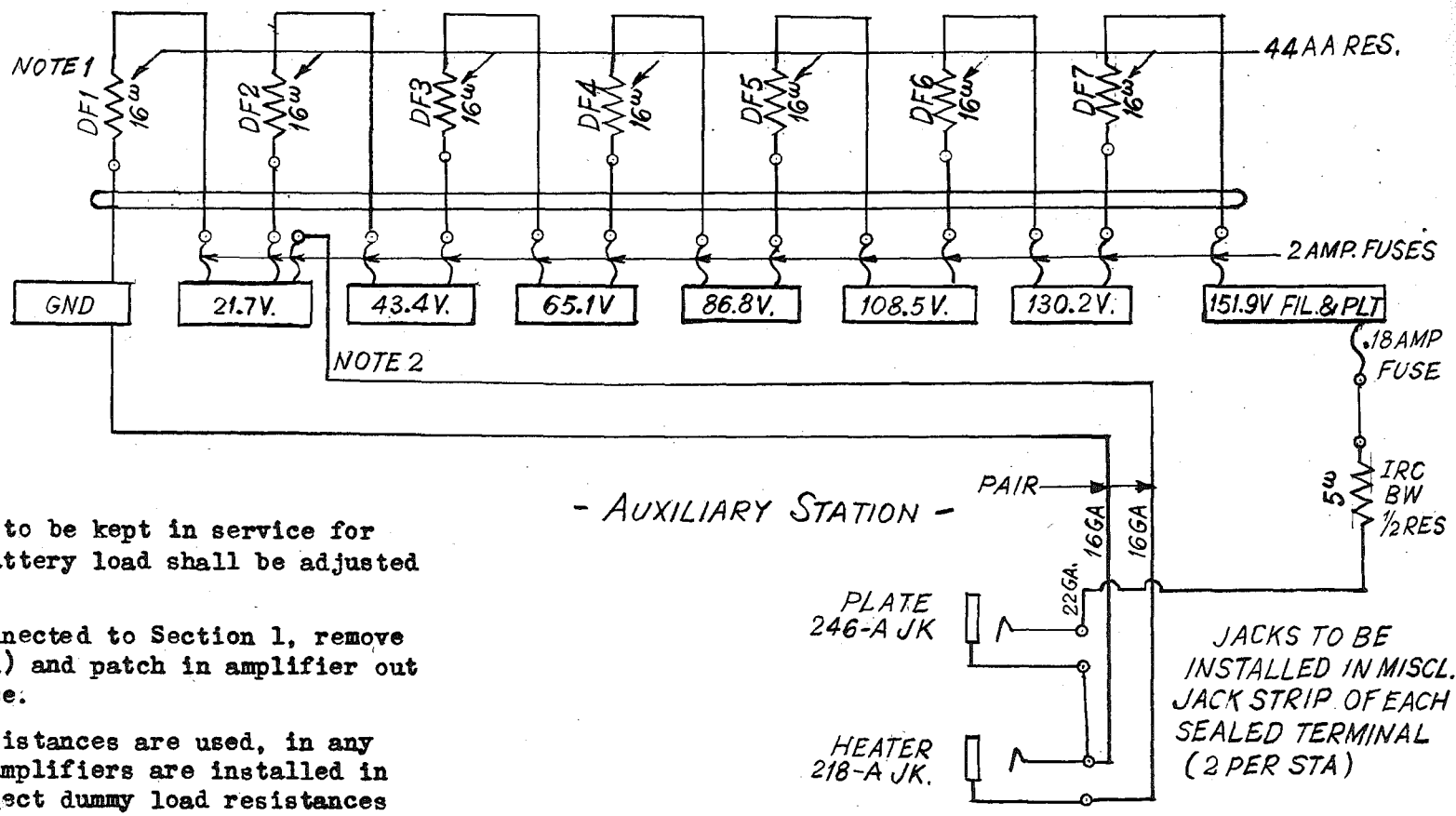
1. ALTERNATE STRAPPING OF 293-A INPUT TRANSFOMER AS COVERED BY NOTE 12 OF DWG. T-64337-30 SHOULD BE MADE BY USING A 552-A KEY OR EQUIVALENT.
2. OPEN "X" STRAP, "Y" STRAP AND STRAP BETWEEN TERMINALS 5 AND 8 OF INPUT TRANSFORMER



PORTABLE TYPE K AMPLIFIER
WIRING OF Equalizers To Key

FIG. 2

See T-64337-30

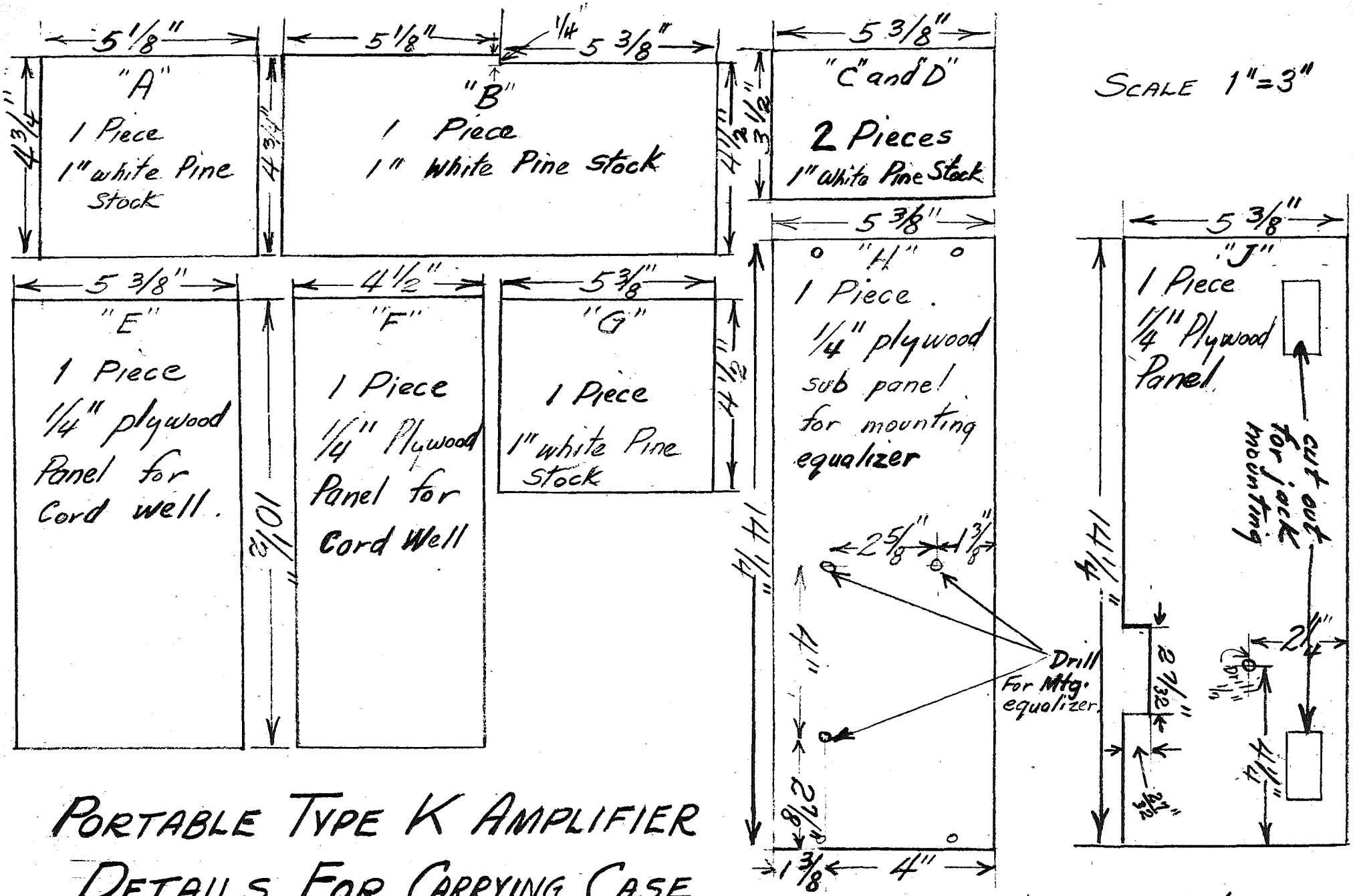


NOTES:

1. If portable amplifier is to be kept in service for prolonged periods, the battery load shall be adjusted as follows:
   (a) If dummy load is connected to Section 1, remove dummy load fuse (DF1) and patch in amplifier out of service resistance.
   (b) If no dummy load resistances are used, in any section (where the amplifiers are installed in multiples of 7) connect dummy load resistances into Sections 2 to 7 of battery and patch amplifier out-of-service resistance to Section 1.
2. Use highest spare fuse location in first group.

FIG. 3

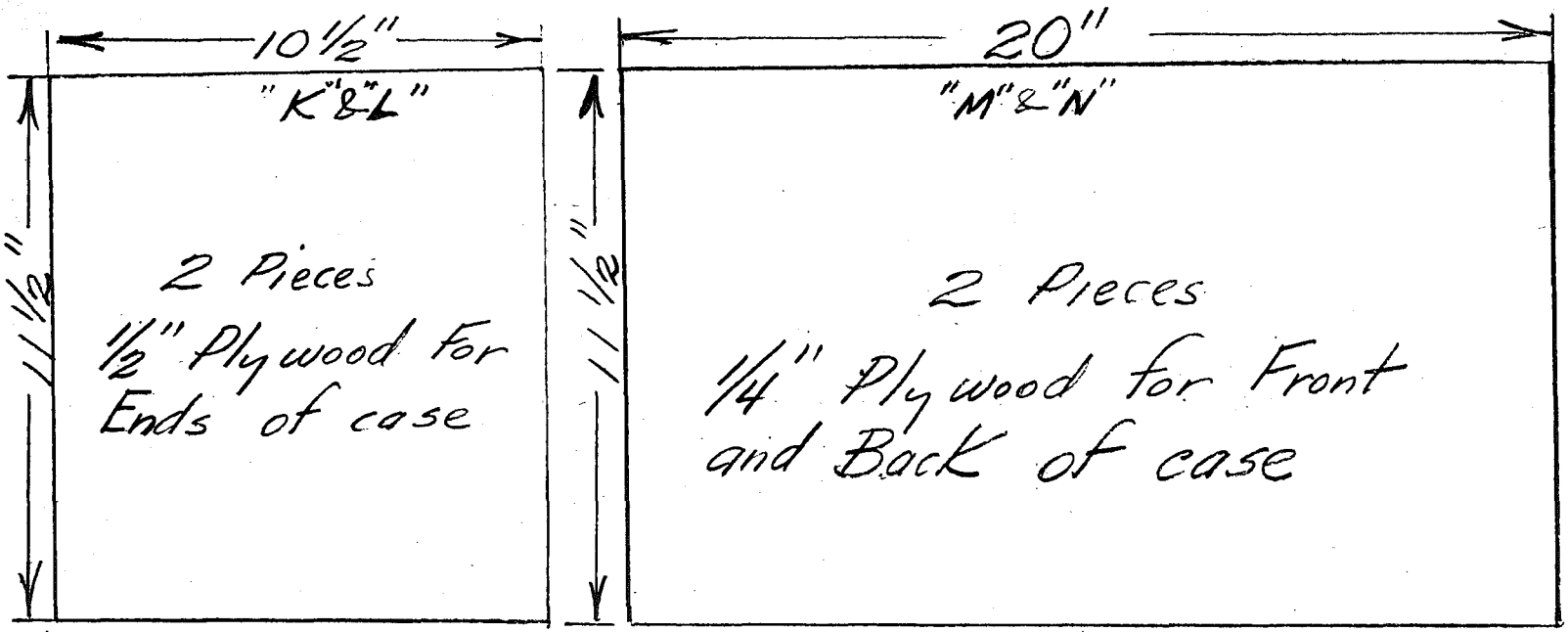
PORTABLE TYPE K AMPLIFIER
WIRING FOR POWER OUTLETS IN AUXILIARY STATION AND MAIN STATION.

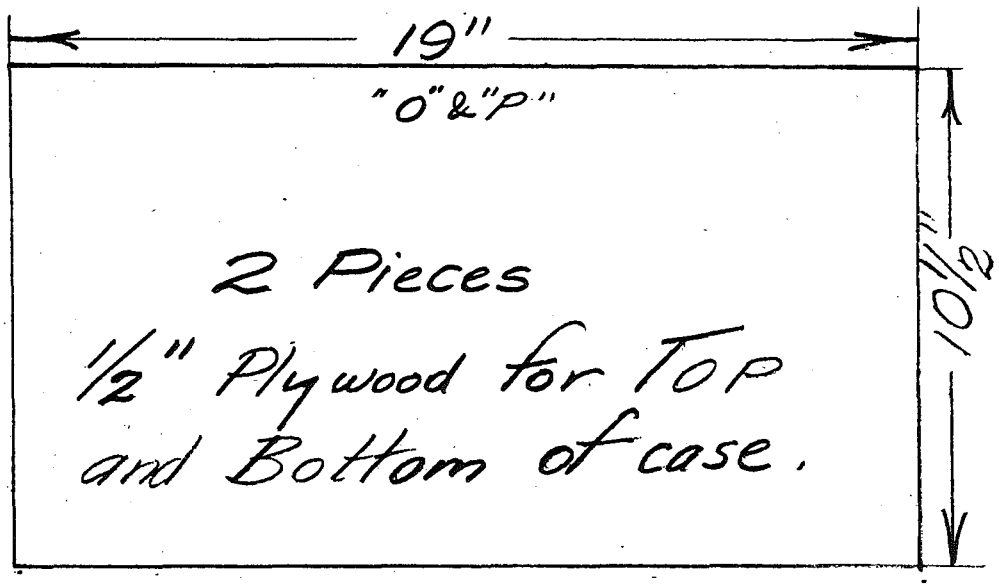


PORTABLE TYPE K AMPLIFIER DETAILS FOR CARRYING CASE

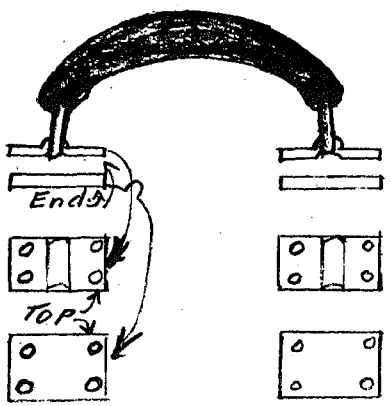
FIG. 4

Note: Fasten wood cleats and inside panels with wood screws.





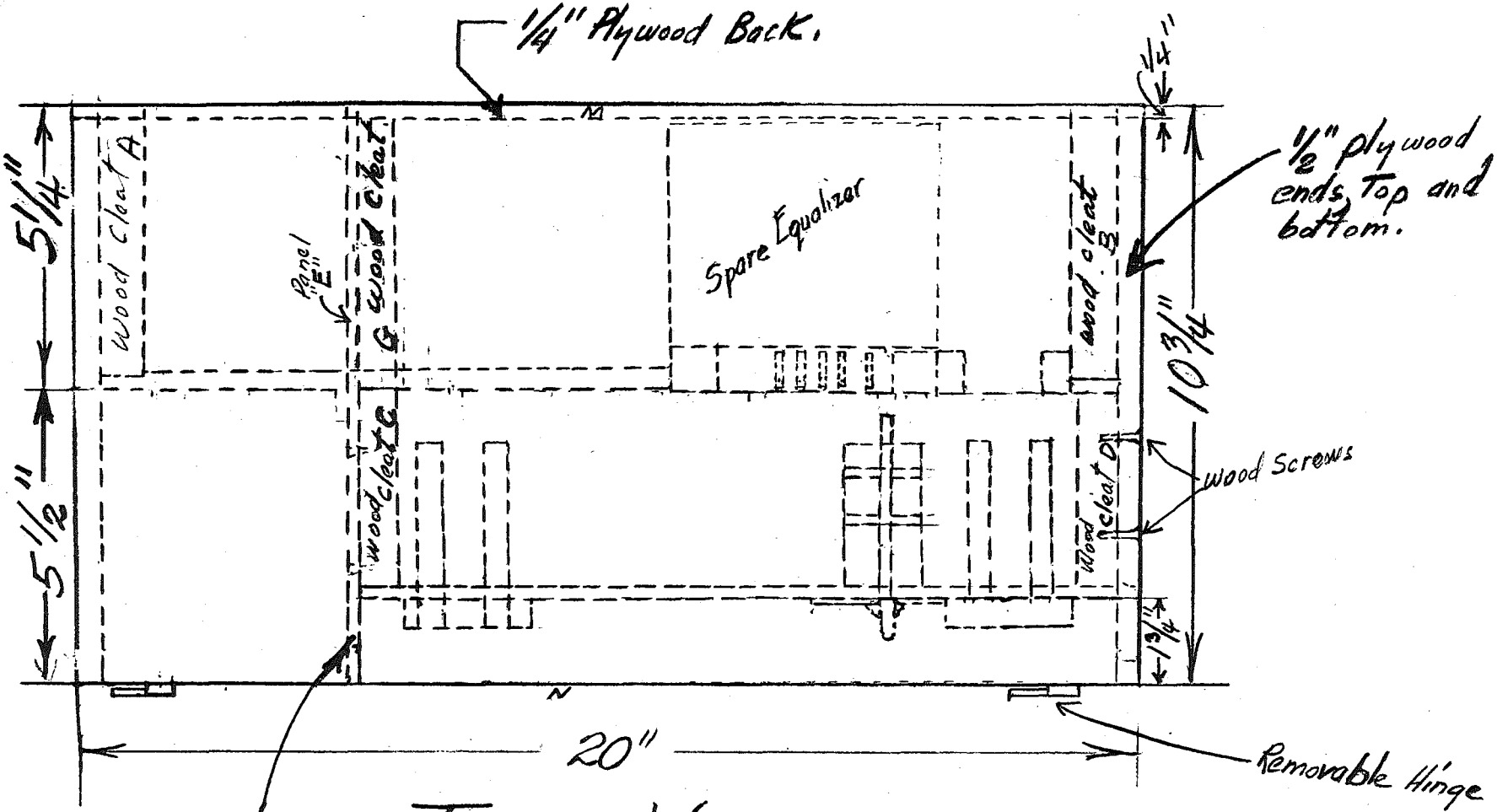
Scale: 1" = 4"



HANDLE
Should be Similar
to one used on
30 A T.M. Set.

PORTABLE TYPE K AMPLIFIER
Details For Carrying Case

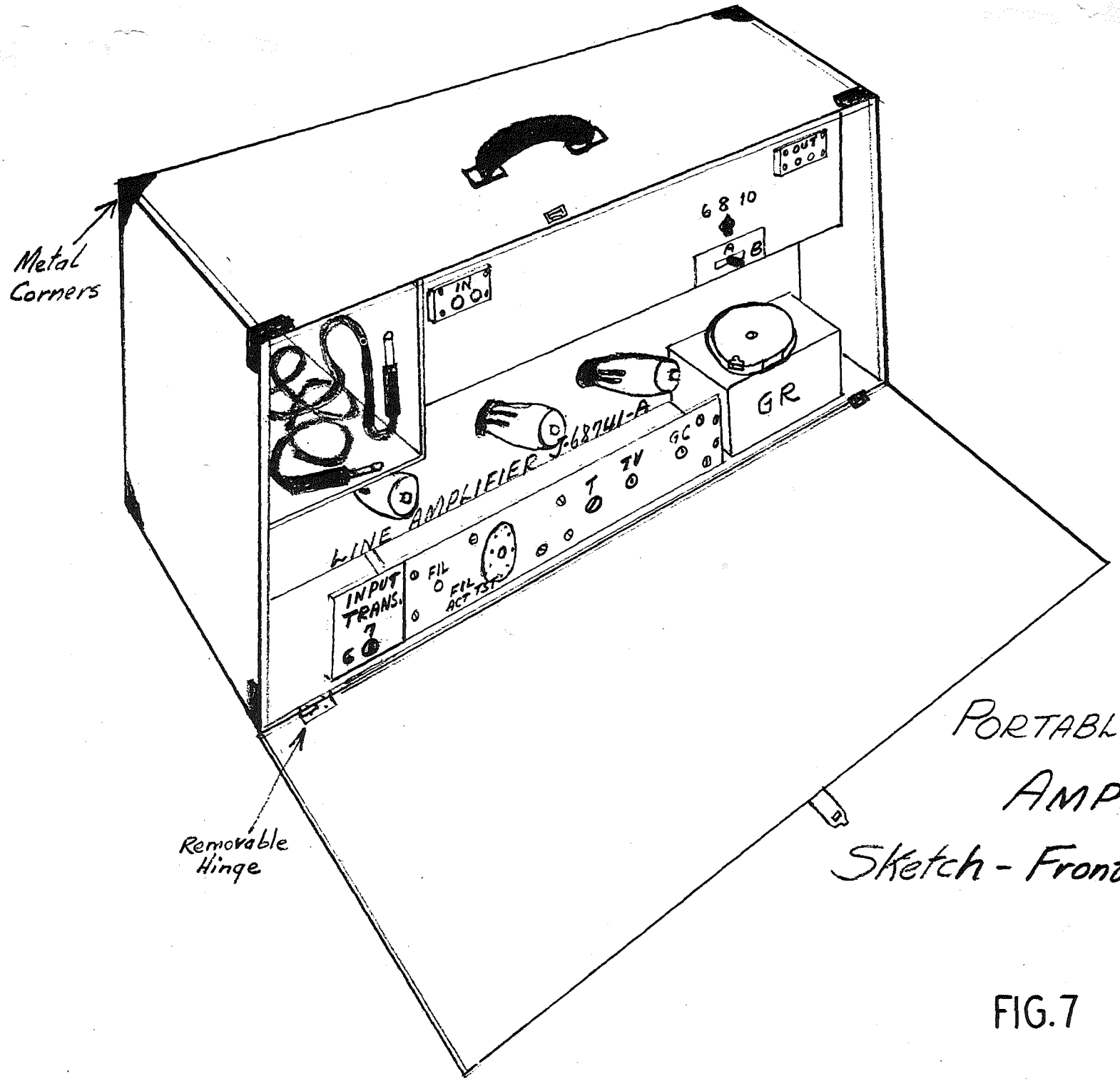
FIG. 5



PORTABLE TYPE K AMPLIFIER

SCALE 1" = 3"

FIG. 6



PORTABLE TYPE K AMPLIFIER Sketch - Front Open

FIG.7